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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte VOLKER BECKER,
FRANZ LAERMER, and ANDREA SCHILP

Appeal 2009-001240
Application 09/762,985
Technology Center 1700

Decided: March 30, 2010

Before CHUNG. K. PAK, CHARLES F. WARREN, and
PETER F. KRATZ, *Administrative Patent Judges*.

WARREN, *Administrative Patent Judge*.

DECISION ON APPEAL

Applicants appeal to the Board from the decision of the Primary Examiner finally rejecting claims 42-45, 47-71, and 74 in the Office Action mailed August 23, 2006. 35 U.S.C. §§ 6 and 134(a) (2002); 37 C.F.R. § 41.31(a) (2007).

We affirm-in-part the decision of the Primary Examiner.

Claims 42 and 74 illustrate Appellants' invention of a method for etching a silicon body substrate, and are representative of the claims on appeal:

42. A method for etching a silicon body substrate using a device having an ICP source for generating a radio-frequency electromagnetic alternating field, a reactor for generating an inductively coupled plasma from reactive particles by the action of the radio-frequency electromagnetic alternating field on a reactive gas, and a first means for generating plasma power pulses to be injected into the inductively coupled plasma by the ICP source, comprising:

matching an impedance of one of an inductively coupled plasma and the ICP source to an ICP coil generator; and

injecting a pulsed radio-frequency power into the inductively coupled plasma as a pulsed plasma power;

wherein the pulsing of the injected, pulsed radio-frequency power is accompanied by a change of a frequency of the injected, pulsed radio-frequency power, the change in the frequency being controlled so that the plasma power injected into the inductively coupled plasma during the pulsing is maximized;

wherein the ICP coil generator causes a variation of the frequency of the radio-frequency electromagnetic alternating field so that the impedance is matched as a function of the pulsed plasma power to be injected, so as to provide rapid switching between the pulses of the pulsed plasma power and interpulse periods;

wherein the variation of the frequency is automatically performed by a Meissner oscillator feedback loop between the ICP coil and the ICP coil generator input without measuring the ratio of magnitudes of applied power and reflected power of the generator.

74. A method for etching a silicon body substrate using a device having an ICP source for generating a radio-frequency electromagnetic alternating field, a reactor for generating an inductively coupled plasma from reactive particles by the action of the radio-frequency electromagnetic alternating field on a reactive gas, and a first means for generating plasma power pulses to be injected into the inductively coupled plasma by the ICP source, comprising:

matching an impedance of one of an inductively coupled plasma and the ICP source to an ICP coil generator; and

injecting a pulsed radio-frequency power into the inductively coupled plasma as a pulsed plasma power;

wherein the pulsing of the injected, pulsed radio-frequency power is accompanied by a change of a frequency of the injected, pulsed radio-frequency power, the change in the frequency being controlled so that the plasma power injected into the inductively coupled plasma during the pulsing is maximized;

wherein the ICP coil generator causes a variation of the frequency of the radio-frequency electromagnetic alternating field so that the impedance is matched as a function of the pulsed plasma power to be injected, so as to provide rapid switching between the pulses of the pulsed plasma power and interpulse periods,

wherein the variation of the frequency is automatically performed by a Meissner oscillator feedback loop between the ICP coil and the ICP coil generator input, and

wherein the variation of the frequency is such as to avoid high reflected powers back into the ICP coil generator when the plasma power is pulsed.

The Examiner relies upon the evidence in these references (Ans. 3):¹

Kadomura	US 5,662,819	Sep. 2, 1997
Koshimizu (Koshimizu '373)	US 5,935,373	Aug. 10, 1999
Koshimizu (Koshimizu '687)	US 5,997,687	Dec. 7, 1999
Wilbur	US 6,020,794	Feb. 1, 2000
Collins	US 6,217,785 B1	Apr. 17, 2001
Savas	WO 97/14177 A1	Apr. 17, 1997

Appellants request review of the grounds of rejection advanced on appeal by the Examiner (App. Br. 8):

¹ We consider the Appeal Brief filed April 7, 2008, the Examiner's Answer mailed June 26, 2008, and the Reply Brief filed September 2, 2008.

claims 42-45 and 47-71 under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement (Ans. 3);

claim 74 under 35 U.S.C. § 103(a) over Kadomura in view of Collins, Wilbur, and Koshimizu '687 (Ans. 5);

claim 74 under 35 U.S.C. § 103(a) over Savas in view of Collins, Wilbur, and Koshimizu '687 (Ans. 7); and

claim 74 under 35 U.S.C. § 103(a) over Koshimizu '373 in view of Collins, Wilbur, and Koshimizu '687 (Ans. 9).

Appellants argue the claims in the first ground of rejection as a group. App. Br. 9. Thus, we decide this appeal based on claims 42 and 74. 37 C.F.R. § 41.37(c)(1)(vii) (2007).

Opinion

Claim 42: §§ 132 and 112, First Paragraph, Written Description Requirement

The limitation of independent claim 42 at issue: “wherein the variation of the frequency is automatically performed by a Meissner oscillator feedback loop between the ICP coil and the ICP coil generator input *without measuring the ratio of magnitudes of applied power and reflected power of the generator*” [emphasis supplied].

The Examiner submits that the Specification, as filed, does not provide support for the negative limitation “without measuring the ratio of magnitudes of applied power and reflected power of the generator,” arguing that the Specification does “not reasonably convey to one skilled in the art that the claimed measurement steps are not performed.” Ans. 3-4. The Examiner contends the negative limitation is not supported in the Specification by disclosure at page 14, lines 10-14, “that both the applied and reflected powers are measured in the instant invention,” and by the

disclosure at pages 2-6, which “would not lead one of ordinary skill in the art to conclude that the negative limitation is supported.” Ans. 12.

Appellants contend that “the specification (see pages 3 to 5) specifically discusses the reflected power problem, [which] makes plain that it solves this problem by using, for example, frequency variation, so that there is no reference to solving the problem by using the prior reference approach of measuring the ratio of magnitudes of applied and reflected power of the generator.” App. Br. 9; Reply Br. second pg.² Appellants further contend Specification Figures 1 and 2 disclose a Meissner oscillator feedback loop formed between the ICP coil and the ICP coil generator, without disclosure of measuring the ratio of magnitudes of applied power and reflected power “as a way to achieve ‘variation of the frequency.’” Reply Br. third pg., citing Specification 10:13-15. Appellants submit that the disclosure at Specification page 14, lines 10-14, “does not specifically recite *measuring the ratio of magnitudes of applied power and reflected power of the generator.*” Reply Br. third pg.

We find Appellants rely on the disclosure at Specification page 13, lines 9-12, and page 15, lines 20-32, for the claim limitation at issue in summarizing the invention. App. Br. 6. These disclosures and intervening disclosure describe Specification Figure 2, which includes, among other things, a Meissner oscillator. *See Spec. 15:20-32.* The disclosure relied on by the Examiner falls therein: “Moreover, generator status outputs 9’ are provided for the feedback of generator data such as generator status, present output power, reflected power, overload, etc. to an external control unit

² We assign numbers to the pages of the Reply Brief which are unnumbered.

(machine control), which is not shown, or to power supply unit 23 of plasma etching system 5.” Spec. 14:10-14. The disclosure at Specification pages 2-6, as relied on by the parties, describes, among other things, problems and controls associated with power reflection and overvoltage known in the art, and Appellants’ disclosed invention, including, among other things, the use of frequency variations, to avoid occasional high reflected powers. Spec., e.g., 2:5-9, 2:31 to 3:2, and 5:1-5. We find Wilbur would have disclosed to one of ordinary skill in this art that in a frequency-tuned RF plasma system, the sensed levels of RF power reflected and RF power forwarded can be processed with an autotuning algorithm to obtain, among other things, the ratio of reflected power to applied power for use in adjusting the frequency of the generator. Wilbur, e.g., col. 3, ll. 5-22, and col. 4, ll. 11-25.

The Examiner has the burden of initially establishing that appealed claim 42 does not comply with § 112, first paragraph, written description requirement, by setting forth evidence or reasons why, as a matter of fact, the written description in the Specification as filed would not reasonably convey to persons skilled in this art that Appellants were in possession of the invention defined by these claims, including all of the limitations thereof, at the time the Application was filed. *See, e.g., In re Alton*, 76 F.3d 1168, 1172, 1175-76, (Fed. Cir. 1996) (citing *In re Wertheim*, 541 F.2d 257, 262-64 (CCPA 1976)). While the written description does not have to describe the invention later claimed *in haec verba*, such written description “must . . . convey with reasonable clarity to those skilled in the art that . . . [appellant] was in possession of the invention . . . now claimed.” *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1563-64 (Fed. Cir. 1991); *see also Purdue*

Pharma L.P. v. Faulding Inc., 230 F.3d 1320, 1323 (Fed. Cir. 2000); *Wertheim*, 541 F.2d at 262-65. Thus, where “the specification contains a description of the claimed invention, albeit not *in ipsius verbis* (in the identical words), then the examiner or the Board, in order to meet the burden of proof, must provide reasons why one of ordinary skill in the art would not consider the description sufficient.” *Alton* 76 F.3d at 1175-76. In this respect, a negative limitation which does not appear in the written description of the specification as filed would cause a claim to violate the written description requirement of § 112, first paragraph, if it introduces new concepts encompassing embodiments outside the scope of the specification. *See Ex parte Grasselli*, 231 USPQ 393 (Bd. App. 1983), *aff’d mem.*, 738 F.2d 453 (Fed. Cir 1984); *see also Alton*, 76 F.3d at 1175-76; *Wertheim*, 541 F.2d at 263-64. Appellants can amend the originally claimed invention to avoid prior art or for other purposes where there is adequate written description in the specification establishing that Appellants were in possession of the invention to which they retreat at the time the Application was filed. *See, e.g., In re Johnson*, 558 F.2d 1008, 1017-19 (CCPA 1977); *Wertheim*, 541 F.2d at 262-64. Compliance with § 112, first paragraph, written description requirement, is a question of fact and is determined on a case-by-case basis. *See, e.g., Vas-Cath*, 935 F.2d at 1562-63; *Johnson*, 558 F.2d at 1019; *Wertheim*, 541 F.2d at 262-65.

On this record, we agree with Appellants that the disclosure in the Specification would have reasonably conveyed to one of ordinary skill in this art that Appellants were in possession of the claimed method encompassed by claim 42 including the limitation at issue here. *See above*

pp. 4-5. In this respect, as Appellants point out, the disclosure at page 14, lines 10-14, of the Specification, cited by the Examiner, which discloses that present output power and reflect power status is obtained as generator feedback data, does not disclose the requirement that such data must be used to measure the ratio of magnitudes of applied and reflected power of the generator in any manner including the method disclosed by Wilbur. *See above* pp. 5-6. Thus, in view of the disclosure in the Specification that reflect power feedback data alone can be used to adjust the generator, as Appellants argue, we are of the opinion that the Examiner has not established that the claimed method, including the negative limitation, encompassed by claim 42 reads on embodiments which are outside of the written description in the Specification,

Accordingly, we are of the opinion that the written description in the disclosure in the Specification reasonably conveys to one skilled in this art that Appellants were in possession of the claimed invention encompassed by appealed claims 42-45 and 47-71, and thus, we reverse the ground of rejection of these claims under 35 U.S.C. § 112, first paragraph, written description requirement.

Claim 74: 35 U.S.C. § 103(a)

We considered the totality of the record in light of Appellants' arguments with respect to independent claim 74 and each of the three grounds of rejection advanced on Appeal under § 103(a). *See, e.g., In re Kahn*, 441 F.3d 977, 985-86 (Fed. Cir. 2006) (“On appeal to the Board, an applicant can overcome a rejection by showing insufficient evidence of *prima facie* obviousness or by rebutting the *prima facie* case with evidence

of secondary indicia of nonobviousness.”) (quoting *In re Rouffet*, 149 F.3d 1350, 1355 (Fed. Cir. 1998)); *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992) (“After evidence or argument is submitted by the applicant in response, patentability is determined on the totality of the record, by a preponderance of evidence with due consideration to persuasiveness of argument.”) (citing, *inter alia*, *In re Spada*, 911 F.2d 705, 707 n.3 (Fed. Cir. 1990)).

We are of the opinion Appellants’ arguments do not establish that the evidence in the totality of the record weighs in favor of the nonobviousness of the claimed a method for etching a silicon body substrate encompassed by claim 74 with respect to each of the three grounds of rejection.

The limitation of independent claim 74 at issue: “wherein the variation of the frequency is such as to avoid high reflected powers back into the ICP coil generator when the plasma power is pulsed.” Unlike claim 42, claim 74 includes this limitation but does not include a negative limitation with respect to measuring the ratio of magnitudes of applied power and reflected power of the generator.

Appellants submit, with respect to each of the three grounds of rejection, that the subject limitation included in claim 74 is not described or suggested in each of the combinations of references applied in the three grounds of rejection. App. Br. 11, 12, and 12-13.

The Examiner “submits that [Wilbur] clearly teaches varying the frequency as to avoid high reflected powers back into the RF power generator.” Ans. 13, citing Wilbur, e.g., abstract, and Figure 1 and accompanying description. The Examiner further argues “that one of

ordinary skill in the art, at the time the invention was made, would understand that high reflected power would be avoided back into the ICP coil generator, as a result from varying the frequency in the” processes taught by each of the combinations of references applied in the three grounds of rejection. Ans. 13.

Appellants reply, with respect to each of the three grounds of rejection, that the cited portion of Wilbur “merely refers to achieving a lowest value of the power ratio, which does not disclose ‘avoid[ing] high reflected powers’ as provided in the context of claim 74.” Reply Br. fourth, fifth, and sixth pgs. Appellants argue that Wilbur does not disclose avoiding high reflected power “‘when the plasma is pulsed’” as claimed. Reply Br. fourth, fifth, and sixth pgs. Appellants contend the Specification “makes it plain that the traditional ‘adiabatic power transition, i.e., a gradual increase or reduction of the injected plasma power’ is not possible in the face of faster changes.” Reply Br. fourth to fifth, fifth to sixth, and sixth to seventh pgs. According to Appellants, this is because Wilbur’s approach to frequency tuning requires many “iterative” steps to attain the minimum ratio, which would be recognized by one of ordinary skill in the art as “an ‘adiabatic power transition’ . . . a type of approach that the presently claimed subject matter tries to avoid.” Reply Br. fifth, sixth, and seventh pgs.

We find Appellants do not define the term “high reflected powers” in claim 74 in the Specification. *See Spec.*, e.g., 5:1-5. Appellants acknowledge that it was known in the art that, among other things, “power reflection and overvoltage occurring with high powers in the kilowatt range to be injected during switching have a destructive effect on the electrical

circuit of the plasma source.” Spec. 2:5-8; *see above* p. 6. Appellants further acknowledge that known systems can control these problems when operating at power ranges in a particular kilowatt range for a given system. Spec. 2:11 to 3:5. Based on Appellants’ characterization of the knowledge in the art, it appears that, among other things, the power reflection and overvoltage problems depend on “the load carrying capacity of the electrical components.” Spec., e.g., 1:26-28, 2:5-9, and 2:18-22.

We find Wilbur would have disclosed that it was known in the art that applied power is adjusted relative to reflected power with respect to a given system for protection of the generator from high reflected power. Wilbur, e.g., col. 1, l. 55 to col. 2, l. 56. In this respect, Wilbur discloses that a determined ratio of reflected power to applied power can be used in adjusting the frequency of the generator. Wilbur, e.g., abstract, col. 3, l. 1 to col. 4, l. 25, and Fig. 1. *See above* p. 6.

We determine the claim term “high reflected powers” in claim 74 is a term of degree relative to the reflected power that the electrical components of a given plasma generating system can tolerate, which term Appellants do not define or otherwise provide some standard for measuring. *See, e.g., Seattle Box Co., Inc. v. Industrial Crating & Packing, Inc.*, 731 F.2d 818, 826 (Fed. Cir. 1984) (“Definiteness problems arise when words of degree are used. That some claim language may not be precise, however, does not automatically render a claim invalid. When a word of degree is used . . . [it] must [be determined] whether the patent’s specification provides some standard for measuring that degree.”).

On this record, we give the claim language “avoid high reflected powers” in claim 74 its ordinary meaning in context of the claim language in light of the disclosure in the Specification and the knowledge in the prior art, as avoiding that level of reflected power which is deleterious to the electrical components of a given plasma generating system. *See, e.g., In re ICON Health and Fitness, Inc.*, 496 F.3d 1374, 1378-79 (Fed. Cir. 2007); *In re Am. Acad. of Sci. Tech Ctr.*, 367 F.3d 1359, 1364 (Fed. Cir. 2004), and cases cited therein; *In re Morris*, 127 F.3d 1048, 1054-55 (Fed. Cir. 1997).

We are of the opinion that the evidence in the record before us supports the Examiner’s position. *See above* pp. 9-10. We are not persuaded otherwise by Appellants’ position that “Wilbur’s approach to frequency tuning” is akin to “adiabatic power transition” that “is not possible in the face of faster changes” and represents an “approach that the claimed subject matter tries to avoid.” *See above* p. 10. Indeed, Appellants do not explain how the language of claim 74 when considered in light of the Specification and the prior art patentably distinguishes over Wilbur.

Accordingly, on this record, we are of the opinion that the combined teachings of each of the three combinations of references would have reasonably suggested the claimed method for etching a silicon body substrate encompassed by claim 74 to one of ordinary skill in this art, including all of the limitations thereof arranged as required therein, without recourse to Appellants’ Specification, even though the claim language “wherein the variation of the frequency is such as to avoid high reflected powers back into the ICP coil generator when the plasma power is pulsed” is not expressly stated in the references. *See, e.g., In re Skoner*, 517 F.2d 947,

950-51 (CCPA 1975) (“Appellants have chosen to describe their invention in terms of certain physical characteristics Merely choosing to describe their invention in this manner does not render patentable their method which is clearly obvious in view of [the reference].” (citation omitted)).

Accordingly, based on our consideration of the totality of the record before us, we have weighed the evidence of obviousness found in the combined teachings of Kadomura, Collins, Wilbur, and Koshimizu ‘687, of Savas, Collins, Wilbur, and Koshimizu ‘687, and of Koshimizu ‘373, Collins, Wilbur, and Koshimizu ‘687 with Appellants’ countervailing evidence of and argument for nonobviousness and conclude, by a preponderance of the evidence and weight of argument, that the claimed invention encompassed by appealed claim 74 would have been obvious as a matter of law under 35 U.S.C. § 103(a).

The Primary Examiner’s decision is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED-IN-PART

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